AC 25.04.24 ITEM NO: 22.5

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for

Program: Master of Science

Course: M.Sc. Part-II (NEP)

Subject: Organic Chemistry

with effect from

Academic Year 2024-2025

Deccan Education Society's

Kirti M. Doongursee College

(autonomous) Proposed Curriculum as per NEP 2020 Year of implementation- 2024-25

Name of the Department: Chemistry

Semester	Course Code	Course Title	Vertical	Credit
III	24CHEMJ911	Theoretical Organic Chemistry I	Major	4
	24CHEMJ912	Synthetic Organic Chemistry I	Major	4
	24CHEMJ913	Green Chemistry and Electro Organic Chemistry	Minor	2
	24CHEEL921	Heterocyclic Chemistry and Spectroscopic Techniques-I	Elective	4
	24CHEMJP91	Practical	Major	4
	24CHERP93	Research Project	RP	4
IV	24CHEMJT11	Theoretical Organic Chemistry II	Major	4
	24CHEMJT12	Synthetic Organic Chemistry II	Major	4
	24CHEELT21	Natural Products Chemistry	Elective	4
	24CHEMJPT1	Practical	Major	4
	24CHERPT3	Research Project	RP	6
	Total			**44**

Semester-III

Course Code	SEM – III M.Sc-II (Organic Chemistry)	Credits	Lectures /Week
24CHEMJ911	**Paper I** **Theoretical Organic Chemistry I**	**4**	**4**

About the Course:

CO1: Recall the Study of stereochemistry of pericyclic reactions.

CO2: Understand photochemical reactions with special reference to cleavage of carbonyl compounds and photochemistry of olefins.

CO3: Apply to predict pathways of reaction mechanism and stability of intermediates.

CO4: Analyze point groups based on symmetry elements and carry out conformational analysis of ring compounds.

Unit	Topics	No of Lectures
I	**PHOTOCHEMISTRY** 1.Photochemistry: 1.1 **General Principles**-Importance and applications of photochemical processes, Mechanism of absorption of photochemically relevant radiation, Excitation and deactivation of molecules, Electronic transitions and states, Selection rules, notations, types and characteristics, Electron energy transfer, photosensitization and quenching processes. **[3L]** 1.2 Photochemistry of carbonyl compounds, π to π*, n to π* transitions, Norrish type-I and Norrish type-II cleavages, Patterno-Buchhi reactions, photo reductions, photochemistry of enones, cyclohexadienones, rearrangements of α,β-unstaurated ketones. **[4L]** 1.3 Photochemistry of unsaturated system-olefins, cis-trans isomerization's and, Di-π methane rearrangement. **[3L]** 1.4 Photochemistry of arenes, 1, 2; 1,3 and 1,4 additions. **[1L]** 1.5 Singlet oxygen and photooxygenation reactions. **[1L]** 1.6 **Intramolecular Rearrangements:** Rearrangements with trimesityl compound to enol ether, o-nitrobenzaldehyde to o-Nitrosobenzoic acid.	**15L**

	Determination of photochemical mechanisms: 1. Use of emission (fluorescence and phosphorescence) and absorption spectroscopy. Energy and life time of singlet and triplet states. 2. The study of quantum yields: primary quantum yields, product quantum yields. **[3L]**	
II	**STEREOCHEMISTRY** 2.1 Stereochemistry of decalins, hydrindanes, steroids and Bridged ring compounds, Bredt's rule,discussion on non-classical carbocation **[4L]** 2.2 Transannular effects, Addition reactions, elimination reactions **[2L]** 2.3 Classification of point groups based on symmetry elements with appropriate examples [non-mathematical treatment] [**2L]** 2.4 **Molecular dissymmetry and chiroptical properties: [4L]** Linearly and circularly polarized light, Circular birefringence and Circular dichroism, ORD and CD curves and their applications, The Octant rule and its applications, Applications of CD in conformational studies of biopolymers. 2.5 **Structures, symmetry and synthesis of 3-prismane and cubane: [3L]** Reactions of cubane and its derivatives, Structures and symmetry of 4/5/6 prismanes and general methods of synthesis of Helicenes and their chiral applications.	**15L**
III	**REACTIVE INTERMEDIATES & PHYSICAL ORGANIC CHEMISTRY** 3.1 **Organic reactive intermediates: [8L]** Methods of generation, Structure, Stability and important reactions of Carbocations [including NGP and non-classical carbocations], Carbenes, Arynes, Nitrenes, ketenes. 3.2 Acid-base catalysis-General and specific acid and base catalysed reactions, Acidity functions and acidity strength, Reaction rates and acidity scales, Mechanism of acid-base catalysis. **[3L]** 3.3 Potential Energy surfaces, Bell-Evans Polanyi principle, Marcus theory, Curtin-Hammett principle **[2L]** 3.4 **Kinetic methods:** Determination of reaction order and rate constants, Empirical rate equations for parallel reactions, Sequential reactions. **[2L]**	**15L**

IV	**PERICYCLIC REACTIONS** 4.1 **Role of FMOs in organic reactivity:** Hard and Soft electrophiles and nucleophiles, Ambident nucleophiles, ambident electrophiles, the □ effect. **[3L]** 4.2 **Classification of pericyclic reactions: [1L]** Thermal and photochemical reactions 4.3 **Three approaches: [2L]** (1) Conservation of orbital symmetry/Correlation Diagram (2) Frontier Molecular Orbital approach [FMO] and (3) Aromatic [Huckel and Mobius] Transition state approach. 4.4 **Cycloaddition reactions: [3L]** 4n and (4n+2) □ electron systems. Diels-Alder reactions, 1,3-Dipolar cycloadditions and Cheletropic reactions, retro-Diels-Alder reaction. Rates of Diels –Alder reaction based on FMOs; regioselectivity, periselectivity and site selectivity in Diels-Alder reactions. 4.5 **Electrocyclic reactions: [2L]** Conrotatory and disrotatory motions, 4n and (4n+2) □ electron systems and other systems. 4.6 **Sigmatropic rearrangements: [3L]** H-Shifts and C-shifts, supra and antarafacial migrations. Retention and inversion of configurations. Cope and Claisen rearrangements 4.7 Diimide reduction reactions, *Group transfer reactions	**15L**

REFERENCE BOOKS:

1. March's Advanced Organic Chemistry, Jerry March, sixth edition, 2007, John Wiley and sons.
2. A guide to mechanism in Organic Chemistry, 6th edition, 2009, Peter Sykes, Pearson education, New Delhi.
3. Advanced Organic Chemistry: Reaction Mechanisms, R. Bruckner, Academic Press (2002).
4. Mechanism and theory in Organic Chemistry, T. H. Lowry and K. C. Richardson, Harper and Row.
5. Organic Reaction Mechanism, 4th edition, V. K. Ahluvalia, R. K. Parashar, Narosa Publication.
6. Reaction Mechanism in Organic Chemistry, S.M. Mukherji, S.P. Singh, Macmillan Publishers, India.

7. Organic Chemistry, Part A and B, Fifth edition,2007, Francis A.Carey and Richard J. Sundberg, Springer.
8. Carbenes, Nitrenes and Arynes. Von T. L. Gilchrist, C. W. Rees. Th. Nelson and Sons Ltd., London 1969.
9. Organic reactive intermediates, Samuel P. MacManus, Academic Press.
10. Organic Chemistry, J. Clayden, S. Warren, N. Greeves, P. Wothers, 1st Edition, Oxford University Press (2001).
11. Organic Chemistry, Seventh Edition, R.T. Morrison, R. N. Boyd & S. K. Bhattacharjee, Pearson.Advanced Organic Chemistry: Reactions & Mechanisms, second edition, B. Miller and R. Prasad, Pearson.
12. Organic reactions & their mechanisms, third revised edition, P.S. Kalsi, New Age International Publishers.
13. Organic Chemistry: Structure and Function, P. Volhardt and N. Schore, 5th Edition, 2012
14. Organic Chemistry, W. G. Solomons, C. B. Fryhle, , 9th Edition, Wiley India Pvt. Ltd.,2009.

Additional References:

15. Pericyclic Reactions, S. Sankararaman, Wiley VCH, 2005.
16. Advanced organic chemistry, Jagdamba Singh L. D. S. Yadav, Pragati Prakashan, 2011
17. Pericyclic reactions, Ian Fleming, Oxford university press, 1999.
18. Pericyclic reactions-A mechanistic approach, S. M. Mukherji, Macmillan Co. of India 1979.
19. Organic chemistry, 8th edition, John McMurry
20. Modern methods of Organic Synthesis, 4th Edition W. Carruthers and Iain Coldham, Cambridge University Press 2004
21. Modern physical chemistry, Eric V Anslyn, Dennis A. Dougherty, University science books,2006
22. Physical Organic Chemistry, N. S. Isaacs, ELBS/Longman
23. Stereochemistry of Carbon Compounds: Principles and Applications, D,Nassipuri, 3rd edition, New Age International Ltd.
24. Stereochemistry of Organic Compounds, Ernest L. Eliel and Samuel H. Wilen, Wiley-India edit
25. Stereochemistry, P. S. Kalsi, 4th edition, New Age International Ltd
26. Organic Stereochemistry, M. J. T. Robinson, Oxford University Press, New

Delhi, India edition, 2005
27. Bioorganic, Bioinorganic and Supramolecular chemistry, P.S. Kalsi and J.P. Kalsi. New Age International Publishers
28. Supramolecular Chemistry; Concepts and Perspectives, J. M. Lehn, VCH.
29. Crown ethers and analogous compounds, M. Hiraoka, Elsevier, 1992.
30. Large ring compounds, J.A.Semlyen, Wiley-VCH, 1997.
31. Fundamentals of Photochemistry, K. K. Rohtagi-Mukherji, Wiley- Eastern
32. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Sciertific Publication.
33. Molecular Photochemistry, N. J. Turro, W. A. Benjamin.
34. Introductory Photochemistry, A. Cox and T. Camp, McGraw-Hill
35. Photochemistry, R. P. Kundall and A. Gilbert, Thomson Nelson.
36. Organic Photochemistry, J. Coxon andB.Halton,Cambridge University Press.
37. Molecular Orbitals and Organic Chemical Reactions by Ian Fleming (Wiley – A john Wiley and Sons, Ltd., Publication)
38. Fundamentals of Photochemistry, K. K. Rohtagi-Mukherji, Wiley- Eastern.
39. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Sciertific Publication.
40. Molecular Photochemistry, N. J. Turro, W. A. Benjamin.
41. Introductory Photochemistry, A. Cox and T. Camp, McGraw-Hill
42. Photochemistry, R. P. Kundall and A. Gilbert, Thomson Nelson.
43. Organic Photochemistry, J. Coxon and B. Halton, Cambridge.

Course Code	**SEM – III M.Sc-II (Organic Chemistry)**	**Credits**	**Lectures /Week**
24CHEMJ912	**Paper II** **Synthetic Organic Chemistry I**	**4**	**4**

About the Course:

CO1: Recall named reactions including multicomponent reactions and Click reactions.

CO2: Understand organic synthesis, Generation, stability, reactivity and structural and stereochemical properties of free radicals and their mechanisms.

CO3: Applications of various reagents in organic synthesis

CO4: Analyze the product formed in the above reactions wrt isomers formed.

Unit	Topics	No. of Lectures
I	**YLIDS, α-C-H ACTIVATION & REACTIONS** 1.1. Methods of preparations, structures and reactivity comparison of phosphorus, sulfur and nitrogen ylides, Reactions of P-, S- and N- ylides with carbonyl compounds and other substrates, including mechanism, stereochemistry and applications in natural product synthesis of Wittig reaction. 1.2. α- C-H activation by nitro, sulfoxide, sulfone and phosphonate groups: generation of carbanions by strong bases (LDA/n-BuLi) and applications in C-C bond formations. Vicarious nucleophilic substitutions 1.3. Bamford-Stevens Reaction, Julia-Kocienski Olefination, Ramberg-Bäcklund Reaction, Staudinger Reaction, Bestmann-Ohira Reagent, Barton-Kellogg olefination, Steven's rearrangement, Pummerer sulfoxide rearrangement	**15L**
II	**RADICALS IN ORGANIC SYNTHESIS** 2.1.**General aspects:** Electrophilic and nucleophilic radicals and their reactivities with □-rich/deficient olefins. 2.2.Inter- and intramolecular aliphatic C-C bond formation via mercury hydride, tin hydride, carbon hydride, thio donor (Barton's radical decarboxylation reaction). 2.3.Cleavage of C-X, C-Sn, C-Co and C-S bonds in the generation of radicals. 2.4.Trapping by electron transfer reactions using Mn(OAc)3. 2.5.**Radical–Radical processes:** oxidative couplings, single electron oxidation of Carbanions to generate radicals, dehydrodimerization and Reductive couplings. 2.6.**C-C bond formation in aromatics:** Introduction, radical reactions on aromatics, electrophilic radical reactions, nucleophilic radicals, Radical reactions on heteroaromatics–alkylations and acylations. 2.7.Hunsdiecker halodecarboxylation, Barton-McCombie alcohol deoxygenation, Kuivila-Beckwith and Stork radical dehalogenation/cyclization, Bergman and Myers-Saito Cycloaromatization.	**15L**

III	**METALS/NON-METALS IN ORGANIC SYNTHESIS** 3.1.Organolithium reagents, Prep and synthetic applications, including directed metallation. Organocupurate reagents. 3.2.Applications of boron: generation of diborane, hydroboration/oxidation of alkenes, alkynes – mechanism, regiochemistry and stereochemistry. Asymmetric hydroboration using chiral borane reagents, functional groups reduction by diborane. 3.3.Mercury in organic synthesis: Oxymercuration-demercuration of alkenes, mechanism and regiochemistry, solvomercuration and intramolecular mercuration. Mercuration of aromatics and transformation of aryl-mercurals to aryl halides. 3.4.Organosilicons: Important features of silicon governing the reactivity of C-Si compounds: Preparation and important C-C bond forming reactions of alkyl silanes, alkenyl silanes, aryl silanes and allyl silanes. Silyl enol ethers as enolate precursors. Iodo trialkyl silane and tralkylsilylcyanide in organic synthesis. 3.5.Organotin compounds: Preparation of alkenyl/aryl and allyl tin compounds and their acylation and Michael reactions. 3.6.Selenium in organic synthesis: preparation of selenols/selenoxide, selenoxide elimination to create unsaturation, selenoxide and seleno-acetals as □-C-H activating groups.	**15L**
IV	**TRANSITION & RARE-EARTH METALS IN ORGAINC SYNTHESIS** 4.1.Basic concepts, 18 electron rule, oxidative addition, reductive elimination, substitution. 4.2.**Pd and Rh in organic synthesis:** π-bonding of Pd and Rh with olefins, applications in C-C bond formations including Wacker process, Heck reaction, Negishi coupling reactions, Carbonylation, hydroformylation, decarbonylation, olefin isomerism, aryl amination using Pd reagents. Olefin metathesis (RCM) using catalysis. 4.3.Applications of nickel, cobalt, iron and chromium carbonyls in organic synthesis 4.4.Selected applications of Samarium iodide, and Cerium (IV), in organic synthesis. 4.5.$Eu(OTf)_3$ and $Sc(OTf)_3$ as efficient, water tolerant	**15L**

	Lewis acid catalysts in aldol condensation, Micheal reactions, Diels-Alder and aza-Diels-Alder reactions, acylation reactions .	

Reference Books:

1. Advanced Organic Chemistry, Part A and Part B: Reaction and Synthesis, Francis A. Carey, Richard J. Sundberg, 5th Edition, Springer Verlag
2. Modern Methods of Organic Synthesis, 4th Edition, W. Carruthers and Iain Coldham, Cambridge University Press, 2004. Chem.Rev. 2002, 102, 2227-2302, Rare Earth Metal Triflates in Organic Synthesis, S. Kobayashi, M. Sugiura, H. Kitagawa, and W.W.L. Lam.
3. Organic Chemistry, Clayden Greeves Warren and Wothers, Oxford Press (2001).
4. Moder Organic Synthesis: An Introduction, G.S. Zweifel and M.H. Nantz, W.H. Freeman and Company, (2007).
5. Advanced Organic Chemistry: Reaction Mechanism, R.Bruckner, Academic Press (2002).
6. Principles of Organic Synthesis, R.O.C. Norman & J. M. Coxon, 3rd Edn., Nelson Thornes Organic Chemistry, 7th Edn, R. T .Morrison, R. N. Boyd, & S. K. Bhattacharjee,
7. Pearson Strategic Applications of Name Reactions in Organic Synthesis, L. Kurti & B. Czako (2005), Elsevier Academic Press
8. Advanced Organic Chemistry: Reactions & Mechanisms, 2nd Edn., B. Miller & R. Prasad, Pearson

Additional References:

9. Organic reactions and their mechanisms, 3rd revisededition, P.S. Kalsi, New Age International Publishers
10. Organic Synthesis: The Disconnection Approach, Stuart Warren, John Wiley & Sons, 2004
11. Name Reactions and Reagents in Organic Synthesis, 2nd Edn., Bradford P. Mundy, Michael G. Ellard, and Frank Favoloro, Jr., Wiley-InterscienceName Reactions, Jie Jack Lie, 3rd Edn., Springer
12. Organic Electrochemistry, H. Lund, and M. Baizer, 3rd Edn., Marcel Dekker.

Course Code	Course Title	Credits	Lectures /Week

24CHEEL921	Paper III Green Chemistry and Electro Organic Chemistry	2	2

About the Course:

CO1: Recall the twelve principles of Green Chemistry and study their applications in synthetic organic chemistry.

CO2: Understand the application of transition metal reagents and catalysts in organic synthesis. Know the use of electrochemical methods for organic synthesis.

CO3: To apply the forward synthesis, recognizable starting material and steps involved in the synthesis of the compound.

CO4: To analyze green chemistry principles in various organic transformations.

Unit	Topics	No of Lectures
I	**Green chemistry** **1.1** Introduction, basic principles of green chemistry. Designing a green synthesis: Green starting materials, green reagents, green solvents and reaction conditions, green catalysts. **1.2** Use of the following in green synthesis with suitable examples: a) Green reagents: dimethylcarbonate, polymer supported reagents. b) Green catalysts: Acid catalysts, oxidation catalysts, basic catalysts, phase transfer catalysts [Aliquat 336, benzyltrimethyl ammonium chloride (TMBA), Tetra-n-butyl ammonium chloride, crown ethers], biocatalysts. c) Green solvents: water, ionic liquids, deep eutectic solvents, supercritical carbon dioxide. d) Solid state reactions: solid phase synthesis, solid supported synthesis e) Microwave assisted synthesis: reactions in water, reactions in organic solvents, solvent free reactions. f) Ultrasound assisted reactions. **1.3** Comparison of traditional processes versus green processes in the syntheses of ibuprofen, adipic	**15L**

	acid, 4-aminodiphenylamine, p-bromotoluene and benzimidazole. **1.4** Green Catalysts: Nanocatalyst, Types of nanocatalysts, Advantages and Disadvantages of Nanocatalysts, Idea of Magnetically separable nanocatalysts.	
II	**Electro-organic chemistry and Selected methods of Organic synthesis** **2.1 Electro-organic chemistry:** **2.1.1** Introduction: Electrode potential, cell parameters, electrolyte, working electrode, choice of solvents, supporting electrolytes. **2.1.2** Cathodic reduction: Reduction of alkyl halides, aldehydes, ketones, nitro compounds, olefins, arenes, electro-dimerization. **2.1.3** Anodic oxidation: Oxidation of alkylbezene, Kolbe reaction, Non-Kolbe oxidation, Shono oxidation. **2.2** Selected Methods of Organic synthesis Applications of the following in organic synthesis: **2.2.1** Crown ethers, cryptands, micelles, cyclodextrins, catenanes. **2.2.2** Organocatalysts: Proline, Imidazolidinone. **2.2.3** Pd catalyzed cycloaddition reactions: Stille reaction, Saeguse-Ito oxidation to enones, Negishi coupling. **3.2.4** Use of Sc(OTf), and Yb(OTf) as water tolerant Lewis acid catalyst in aldol condensation, Michael reaction, Diels-Alder reaction, Friedel – Crafts reaction.	**15L**

Textbooks and References:

1. Name Reactions, Jie Jack Lie, 3rd Edn., Springer
2. Organic Electrochemistry, H. Lund, and M. Baizer, 3rd Edn., Marcel Dekker
3. Green Chemistry: An Introductory Text, 2nd Edition, Published by Royal Society of Chemistry, Authored by Mike Lancater.
4. Organic synthesis in water. By Paul A. Grieco, Blackie.
5. Green chemistry, Theory and Practical, Paul T. Anastas and John C. Warner.
6. New trends in green chemistry By V. K. Ahulwalia and M. Kidwai, 2nd edition, Anamaya Publishers, New Delhi.

Additional References:

7. An introduction to green chemistry, V. Kumar, Vishal Publishing Co.
8. Organic synthesis: Special techniques. V.K.Ahulwalia and Renu Aggarwal.

Course Code	SEM – III M.Sc-II (Organic Chemistry)	Credits	Lectures/ Week
24CHEEL921	**Elective-I Heterocyclic Chemistry and Spectroscopic Techniques-I**	**4**	**4**

About the Course:

CO1: Recall the rules of IUPAC nomenclature and other methodologies towards nomenclature of heterocycles and methods of spectroscopic analysis.

CO2: Understand an enhanced approach towards structural elucidation. Understand the reactivity of various heterocyclic molecules.

CO3: Apply to develop a problem solving approach towards the structural elucidation from spectral data and reactions of heterocycles.

CO4: To Analyze basic concepts and sample handling. Prediction of structure of organic compounds based on the use of chemical shift and J values. Analyze the importance of synthesis of certain biologically active molecules.

Unit	Topics	No. of Lectures
I	**HETEROCYCLIC CHEMISTRY-I** 1.1 Introduction, Classification, IUPAC and common names of mono-and bicyclic fused Heteroaromatic compounds. **[5L]** 1.2 **Reactivity, important general methods of synthesis and selected applications of the following heterocycles: [10L]** Pyrazole, imidazole, oxazole, isoxazole, thiazole, benzimidazole, benzoxazole, benzthiazole,pyridine and pyridine N-oxide.	**15L**
II	**HETEROCYCLIC CHEMISTRY-II** **2.1.Reactivity, important general methods of synthesis and selected applications of the following Heterocycles:** Pyridazine, pyrimidine, pyrazine, oxazine, quinoline, isoquinoline, coumarin, indole, purine, s-triazine, benzodiazepine, piperidine, morpholine.	**15L**
III	**ADVANCED SPECTROSCOPIC TECHNIQUES-I** 3.1.**FT-IR Spectroscopy:** Principle and applications [**2L]** 3.2.**NMR Spectroscopy:** Relaxation phenomenon and relaxation time, First order, higher order spectra and their simplifications, Double resonance,NOE,NOE difference spectroscopy and chemical shift reagents.	**15L**

	[3L] 3.3.**Second order spectra:** Spin system notation, AB, AX, AB2-AX2, ABX, AMX and A2B2-A2X2 spin system with suitable examples, Coupling in aromatic and heteroaromatic systems,long range coupling. **[2L]** 3.4.Spectra of diastereotopic systems [**1L]** 3.5.**ESR:** Fundamentals and applications **[2L]** 3.6.**Fluorescence Spectroscopy :** Principles and applications [**2L]** 3.7.**Problems**	
IV	**ADVANCED SPECTROSCOPIC TECHNIQUES-II** 4.1.**FT-NMR:**Pulse sequences,pulse widths,spins and magnetisation vectors. **[1L]** 4.2.**13C -NMR:**13C nucleus,13C- chemical shifts,Calculation of 13C- chemical shifts, proton coupled 13 C - spectra,13C spectra Integration, proton decoupled 13C- spectra. Off- resonance decoupling,DEPT technique, heteronuclear coupling of carbon to 19F and 31P **[3L]** 4.3.**19F-NMR:** Principles and applications **[2L]** 4.4.**31P- NMR:** Principles and applications **[2L]** 4.5.**Two dimensional NMR:** Introduction, COSY technique and overview of COSY experiment, how to read COSY spetra, HETCOR technique and overview of the HETCOR experiment, how to read HETCOR spectra. **[2L]** 4.6.NOESY, ROESY, HMBC, INADEQUATE techniques [**2L]** 4.7. Problems **[2L]** 4.8. Applications of NMR in medicine **[1L]**	**15L**

Reference Books:

1. Heterocyclic chemistry, 3rd edition, Thomas L. Gilchrist, Pearson Education, 2007.
2. Heterocyclic Chemistry, Synthesis, Reactions and Mechanisms, R.K.Bansal, Wiley Eastern Ltd., 1990.
3. Heterocyclic Chemistry, J. A. Joule and G. F. Smith, ELBS, 2nd edition, 1982.
4. The Conformational Analysis of Heterocyclic Compounds, F.G. Riddell, Academic Press,1980.
5. Principles of Modern Heterocyclic Chemistry, L.A. Paquette, W.B. Benjamin, Inc., 1978.
6. An Introduction to the Chemistry of Heterocyclic Compounds, 2nd edition, B.M. Acheson, 1975.
7. Spectroscopy of Organic compounds, P.S. Kalsi, New Age International Pub. Ltd. And Wiley Eastern Ltd., Second edition, 1995.
8. Applications of Absorption Spectroscopy of Organic compounds, J.R. Dyer, Prentice Hall of India, 1987.
9. Spectrometric Identification of Organic compounds, R.M. Silverstein and others, John Wiley and Sons Inc., 5th ed., 1991
10. Absorption spectroscopy of organic Molecules, V.M. Parikh, 1974.
11. Spectroscopic methods in organic chemistry, Williams and Fleming, Tata McGraw Hill, 4th ed, 1989.
12. Organic spectroscopy, William Kemp, ELBS, 3rd ed., 1987.
13. Organic structures from spectra, L. D. Field, S. Sternhell, John R. Kalman, Wiley, 4th ed., .3122
14. Introduction to spectroscopy, Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, 4th ed., 2009.
15. Organic spectroscopic structure determination: a problem-based learning approach Douglass F. Taber, Oxford University Press, 17- Sep-2007.

Additional References:

1. Organic Spectroscopy: Principles And Applications, Jag Mohan, Alpha Science International Ltd., 30-Mar-2004
2. Heterocyclic Chemistry, Vols. 1-3, R.R. Gupta, M. Kumar and V. Gupta, Springer Verlag.
3. The Chemistry of Heterocycles, T. Eicher and S. Hauptimann, Thieme.

4. Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, Chapman and Hill.
5. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Tech.
6. Contemporary Heterocyclic Chemistry, G.R. Newkome, and W. W. Paudler, Wiley-Inter Science.

Course Code	SEM III M.Sc-II (Organic Chemistry)	Credits	Lectures /Week
24CHEMJP91	**Practical P1**	**4**	**8**

About the Course:

After successful completion of this course, students would be able to –

CO1: Recall Ternary mixture and derivatives/ Reactions of synthetic methods.

CO2: TO understand Ternary mixture separation and preparation of derivatives/ Chemical tables, column chromatography.

CO3: Apply the knowledge to separation of ternary mixtures/ Finding Solvent systems for column chromatography.

CO4: To analyze and Identify of organic compounds/ Purity of products before and after purification.

Separation of a ternary mixture of organic compounds and identification including derivative preparations using micro-scale technique (Minimum 8 experiments)

1	1. Separation of a ternary mixture (S-S-S, S-S-L, S-L-L and L-L-L) (for solid mixture: water insoluble/ soluble including carbohydrates) based upon differences in the physical and the chemical properties of the components. 2. Identification of the two components (indicated by the examiner) using micro-scale technique. 3. Preparation of derivatives (any one of separated compounds). **(Minimum 8 experiments)**

Single step organic preparation-

Single step organic preparation(1.0 g scale) involving purification by

Steam distillation / Vacuum distillation or Column chromatography. (1.0 g scale): **(Minimum 8 experiments)**

1. Students are expected to know (i) the planning of synthesis, effect of reaction parameters including stoichiometry, and safety aspects including MSDS (ii) the possible mechanism, expected spectral data (IR and NMR) of the starting material and final product.

2. Students are expected to purify the product by Steam distillation /Vacuum distillation or Column chromatography, measure its mass or volume, check the purity by TLC, determine physical constant and calculate percentage yield**.**

1	Preparation of acetanilide from aniline and acetic acid using Zn dust.(Purification by column chromatography)
2	Preparation of 1-nitronaphthalene from naphthalene. (Purification by steam distillation)
3	Preparation of acetyl ferrocene from ferrocene. (Purification by column chromatography)
4	Preparation of 3-nitroaniline from 1,3-dinitrobenzene. (Purification by column chromatography)
5	Preparation of benzyl alcohol from benzaldehyde. (Purification by vacuum distillation).

Course Code	SEM III M.Sc-II (Organic Chemistry)	Credits	Lectures
24CHERP93	**Research Project**	**4**	**120**

Course Outcomes:

Students are Expected to find research problem and do literature survey and prepare project proposal for the same problem.

6	Preparation of methyl salicylate from salicylic acid. (Purification by vacuum distillation).
7	Preparation of 4-methylacetophenone from toluene. (Purification by vacuum distillation).
8	Preparation of phenyl acetate from phenol. (Purification by vacuum distillation)
9	Preparation of 2-chlorotoluene from o-toluidine. (Purification by steam distillation)
10	Preparation of 4-nitrophenol from phenol. (Purification by steam distillation/ column chromatography)
11	Preparation of fluorenone from fluorene. (Purification by column chromatography)
12	Preparation of dimethylphthalate from phthalic anhydride. (Purification by vacuum distillation)

Semester-IV

Course Code	SEM – IV M.Sc-II (Organic Chemistry)	Credits	Lectures /Week
24CHEMJT11	**Paper-I Theoretical Organic Chemistry II**	**4**	**4**

About the Course:

CO1: Recall to correlate the effects of substituent's on a substrate with its reactivity.

CO2: Understand enantiomeric and diastereomeric compositions using various available methods.

CO3: Apply to importance and challenges in asymmetric synthesis, exemplified by Felkin-Anh and chelation models and asymmetric aldol reactions.

CO4: To Analyze of Asymmetric Synthesis controlled by Chiral Auxiliary, chiral catalyst, chiral substrate and chiral reagent with examples.

Unit	Topics	No of Lectures
I	**STEREOCHEMISTRY** 1.1.Racemates and methods of resolution of racemates. **[3L]** 1.2.Chemical and Instrumental methods of determining configurations. [**4L]** 1.3.Conformation and reactivity in cyclic compounds with more emphasis on cyclohexane derivatives, Reactions involving steric factors and stereoelectronic factors, Addition reactions, substitution reactions, elimination reactions, rearrangement reactions, I-strain concept. **[4L]** 1.4.Determination of enantiomer and diastereomer composition. (a) Chiroptical methods and their limitations [Horeau effect] (b) **Methods based NMR:** Use of Chiral Derivatising Agents, CDA, Chiral Solvating Agents, CSA, and Chiral Shift	**15L**

	Reagents, CSR.; (c) Chromatographic methods, use of chiral stationary phase (chiral columns) **[4L]**	
II	**ASYMMETRIC SYNTHESIS** Principles of asymmetric synthesis, Cram's rule, Sharpless epoxidation, asymmetric dihydroxylaion, asymmetric aminohydroxylations, asymmetric Diels-Alder reactions, chiral borane reagents, asymmetric reductions of prochiral carbonyl compounds and olefins. Use of chiral auxiliaries in Diastereoselective reductions. Synthesis of alpha amino acids (Corey's Diastereoselective hydrogenation of cyclic hydrazones); Synthesis of LDOPA [Knowles's Mosanto process], asymmetric aldol and related reactions. Use of Chiral BINOLs, BINAPs, and chiral oxazolines and oxazolidines in asymmetric transformations.	**15L**
III	**THEORETICALLY FASCINATING MOLEUCLES** 3.1.Structures, synthesis and properties of cyclophanes, calixarenes, C-60, rotaxanes **[5L]** 3.2.Design, operating photophysical principles, synthesis of selected chemo-and fluorescence based metal ion sensors derived from crown ethers and macrocyclic systems, and chemoand fluorophore chelators. **[8L]** 3.3.**The Host Guest binding phenomena:** Assessment by UV/VIS or Flourescence methods; NMR methods. The Benesi-Hildebrand Equation, Stern Volmer relationships **[2L]**	**15L**
IV	**ORGANIC, ELCTERONIC & PHOTONIC MOLECULES** Organic nonlinear chromophores, Conducting polymers, Dye sensitized organic photovoltaic materials, Organic Magnetic materials, Organic light emitting diodes. General examples of organic conjugated chromophores and polymers, synthesis and various applications	**15L**

1. References

2. Stereochemistry of Carbon Compounds: Principles and Applications, D, Nassipuri, 3rd edition, New Age International Ltd.
3. Stereochemistry of Organic Compounds, Ernest L. Eliel and Samuel H. Wilen, Wiley-India edit
4. Stereochemistry of carbon compounds, E.L Eliel, S.H Wilen and L.N Manden, Wiley.
5. Stereochemistry of Organic Compounds- Principles and Applications, D. Nasipuri. New International Publishers Ltd.
6. Physical Organic Chemistry, N. S. Isaacs, ELBS/Longman
7. Stereochemistry of Carbon Compounds: Principles and Applications, D, Nasipuri, 3**rd** edition, New Age International Ltd.
8. Stereochemistry of Organic Compounds, Ernest L. Eliel and Samuel H. Wilen, Wiley-India edit Organic chemistry, 8th edition, John McMurry
9. Modern methods of Organic Synthesis, 4th Edition W. Carruthers and Iain Coldham, Cambridge University Press 2004
10. Modern physical chemistry, Eric V Anslyn, Dennis A. Dougherty, University science books,2006
11. March's Advanced Organic Chemistry, Jerry March, sixth edition, 2007, John Wiley and sons.
12. A guide to mechanism in Organic Chemistry, 6**th** edition, 2009, Peter Sykes, Pearson education, New Delhi.
13. Advanced Organic Chemistry: Reaction Mechanisms, R. Bruckner, Academic Press (2002).
14. Mechanism and theory in Organic Chemistry, T. H. Lowry and K.Richardson, Harper and Row.
15. Organic Reaction Mechanism, 4th edition, V. K. Ahluvalia, R. K. Parashar, Narosa Publication.
16. Reaction Mechanism in Organic Chemistry, S.M. Mukherji, S.P. Singh, Macmillan Publishers, India.
17. Organic Chemistry, Part A and B, Fifth edition,2007, Francis A. Carey and Richard J. Sundberg, Springer.
18. Carbenes, Nitrenes and Arynes. Von T. L. Gilchrist, C. W. Rees. Th. Nelson and Sons Ltd., London 1969.
19. Organic reactive intermediates, Samuel P. MacManus, Academic Press.

20. **Additional References:**

21. Organic Chemistry, J. Clayden, S. Warren, N. Greeves, P. Wothers, 1st Edition, Oxford University Press (2001).
22. Organic Chemistry, Seventh Edition, R.T. Morrison, R. N. Boyd &
23. S. K. Bhattacharjee, Pearson.Advanced Organic Chemistry: Reactions & Mechanisms, second edition, B. Miller and R. Prasad, Pearson.
24. Organic reactions & their mechanisms, third revised edition, P.S. Kalsi, New Age International Publishers.
25. Organic Chemistry: Structure and Function, P. Volhardt and N. Schore, 5th Edition, 2012

26. Organic Chemistry, W. G. Solomons, C. B. Fryhle, , 9th Edition, Wiley India Pvt. Ltd.,2009.

Course Code	SEM – IV M.Sc-II (Organic Chemistry)	Credits	Lectures /Week
24CHEMJT12	**Paper-II** **Synthetic Organic Chemistry II**	**4**	**4**

About the Course:

CO1: Recall Named reactions including multicomponent reactions and Click reactions.

CO2: Understand Predict pathways of reaction mechanism and stability of intermediates.

CO3: Apply to the propose a retrosynthetic strategy for an organic compound.

CO4: To Analyze the forward synthesis, recognizable starting material and steps involved in the synthesis of the compound.

CO5: Know the current trends in synthesizing organic compound. Explore the applications of modern and greener methods of organic synthesis.

CO6: Retrosynthetic analysis and synthetic planning: Linear and convergent synthesis.

Unit	Topics	No. of Lectures
I	**DOMINO REACTION & CLICK CHEMISTRY** 1.1.Multi-component reactions: i) Strecker reaction ii) Hantzsch dihydropyridine synthesis iii) Biginelli condensation iv) Passerni 3- component condensation v) Ugi 4- component condensation iv) Domino Knoevenagel-hetero-Diels-Alder reaction. 1.2.Domino Reactions/Tandem Reaction/Cascade Reactions: Definition and Classification Cascade processes: concept, examples of cationic, anionic and radical initiated cascade reactions. 1.3.Click Chemistry reactions	**15L**
II	**POLYMER SUPPORTED REAGENTS & ELECTROORGANIC SYNTHESIS** 2.1.Polymer supported reagents for acid base	**15L**

	catalysis, 2.3.Introduction: Electrode potential, cell parameters, electrolyte, working electrode, choice of solvents, supporting electrolytes. 2.4.Cathodic reductions: alkyl halides, aldehydes/ketones, nitro compounds, olefin, arenes, Electrodimerizations. 2.5.Anodic oxidations,: Kolbe type reactions, oxidation of arylalkanes .	
III	**NON-CLASSICAL METHODS OF ORGANIC SYNTHESIS** **Principles and applications of the following:** 3.1.1) Phase transfer catalysis, crown ethers and cryptands, concepts, synthesis and applications 2) Micelles, structures, properties and reactions 3) Ionic liquids 4) cyclodextrin, structure and functions 5) ultrasound in organic synthesis 6) Zeolites, structures, properties and catalysis and Organocatalysis 7) Microwave in organic synthesis 8) Solid phase synthesis	**15L**
IV	**DESIGNING ORGANIC SYNTHESIS** 4.1.**Umpolung:** Concept of umpolung, generation of acyl anion equivalent-1,3- dithiane from carbonyl compounds, use of methylthio-methylsulfoxide, via cyanide ion and cyanohydrin ethers, nitro compounds and metallated vinyl ethers 4.2.**Methodology in organic synthesis:** Functional group interconversions, general methods of 4 -7 membered ring formation, Disconnection approach and Retrosynthetic analysis, ideas of synthones and retrones, Examples of acyclic saturated and unsaturated systems, monocyclic and bicyclic compounds. 4.3.**Target oriented and methods oriented synthesis**: Strategies and tactics. 4.4 .**Protection-deprotection of functional groups:** carbonyl, hydroxyl, amino, carboxyl, with examples	**15L**

	illustrating the applications of each.	

Textbooks and References:

1. Advanced Organic Chemistry, Part A and Part B: Reaction and Synthesis, Francis A. Carey, Richard J. Sundberg, 5th Edition, Springer Verlag
2. Modern Methods of Organic Synthesis, 4th Edition, W. Carruthers and Iain Coldham, Cambridge University Press, 2004. Chem.Rev. 2002, 102, 2227-2302,
3. Rare Earth Metal Triflates in Organic Synthesis, S. Kobayashi, M. Sugiura, H. Kitagawa, and W.W.L. Lam.
4. Organic Chemistry, Clayden Greeves Warren and Wothers, Oxford Press (2001).
5. Moder Organic Synthesis: An Introduction, G.S. Zweifel and M.H. Nantz, W.H. Freeman and Company, (2007).
6. Advanced Organic Chemistry: Reaction Mechanism, R.Bruckner, Academic Press (2002).
7. Principles of Organic Synthesis, R.O.C. Norman & J. M. Coxon, 3rd Edn., Nelson Thornes
8. Organic Chemistry, 7th Edn, R. T .Morrison, R. N. Boyd, & S. K. Bhattacharjee, Pearson
9. Strategic Applications of Name Reactions in Organic Synthesis, L. Kurti & B. Czako (2005), Elsevier Academic Press
10. Advanced Organic Chemistry: Reactions & Mechanisms, 2nd Edn., B. Miller & R. Prasad, Pearson
11. Organic reactions and their mechanisms, 3rd revisededition, P.S. Kalsi, New Age International Publishers
12. Organic Synthesis: The Disconnection Approach, Stuart Warren, John Wiley & Sons, 2004
13. Name Reactions and Reagents in Organic Synthesis, 2nd Edn., Bradford P. Mundy, Michael G. Ellard, and Frank Favoloro, Jr., Wiley-InterscienceName Reactions, Jie Jack Lie, 3rd Edn., Springer
14. Organic Electrochemistry, H. Lund, and M. Baizer, 3rd Edn., Marcel Dekke
15. March's Advanced Organic Chemistry, Jerry March, sixth edition, 2007, John Wiley and sons.

Additional References:

16. A guide to mechanism in Organic Chemistry, 6th edition, 2009, Peter Sykes, Pearson education, New Delhi.
17. Advanced Organic Chemistry: Reaction Mechanisms, R. Bruckner, Academic Press (2002).
18. Mechanism and theory in Organic Chemistry, T. H. Lowry and K. C. Richardson, Harper and Row.
19. Organic Reaction Mechanism, 4th edition, V. K. Ahluvalia, R. K. Parashar, Narosa Publication.

20. Reaction Mechanism in Organic Chemistry, S.M. Mukherji, S.P. Singh, Macmillan Publishers, India.
21. Organic Chemistry, Part A and B, Fifth edition,2007, Francis A.Carey and Richard J. Sundberg, Springer.
22. Carbenes, Nitrenes and Arynes. Von T. L. Gilchrist, C. W. Rees. Th. Nelson and Sons Ltd., London 1969.
23. Organic reactive intermediates, Samuel P. MacManus, Academic Press.
24. Organic Chemistry, J. Clayden, S. Warren, N. Greeves, P. Wothers, 1st Edition, Oxford University Press (2001).
25. Organic Chemistry, Seventh Edition, R.T. Morrison, R. N. Boyd & S. K. Bhattacharjee, Pearson.Advanced Organic Chemistry: Reactions & Mechanisms, second edition, B. Miller and R. Prasad, Pearson.
26. Organic reactions & their mechanisms, third revised edition, P.S. Kalsi, New Age International Publishers.
27. Organic Chemistry: Structure and Function, P. Volhardt and N. Schore, 5th Edition, 2012
28. Organic Chemistry, W. G. Solomons, C. B. Fryhle, , 9th Edition, Wiley India Pvt. Ltd.,2009.

Course Code	**SEM – IV M.Sc-II (Organic Chemistry)**	**Credits**	**Lectures /Week**
24CHEELT21	**Paper-III NATURAL PRODUCTS CHEMISTRY**	**4**	**4**

About the Course:

CO1: Define structures and stereo chemical features of the following: corticosteroids, steroidal hormones, steroidal alkaloids, sterols and bile acid.

CO2: Understand the occurrence and biological roles of steroids, vitamins,

terpenoids and antibiotics.

CO3: Apply to synthetic strategies towards the synthesis of important biologically active molecules.

CO4: To analyze basic terms involved in medicinal chemistry, procedures involved in drug design and factors affecting the activity and potency of a particular drug

CO5: Understand the effect of Structure-Activity Relationship on drug function and the concept of pro-drugs.

Unit	Topics	No. of Lectures
I	**NATURAL PRODUCTS CHEMISTRY-I** 1.1.**Steroids:** Occurrence,structures, classification biological role, important structural and stereochemical features of the following types of steroids- Estrogens, gestrogens, androgens, corticosteroids, sterols, bile acids, calciferol, sapogenins and steroidal alkaloids. **[5L]** 1.2.Synthesis of 16-DPA from cholesterol and plant sapogenin. **[3L]** 1.3. Synthesis of commercially important steroids from 16-DPA. **[4L]** 1.4.Synthesis of cinerolone, Jasmolone,allethrolone,pyrethrolone,exaltone and muscone. **[3L]**	**15L**
II	**NATURAL PRODUCTS CHEMISTRY-II** 2.1.**Insect pheromones:** Structural features and importance .Synthesis of bombycol, gossyplure, disparlure, brevicomin and grandisol **[5L]** 2.2.**Insect growth regulators:** General idea,constitution of JH, structures of JH_2 and JH_3 [**2L]** 2.3.**Plant growth regulators**: Structural features and applications of aryl acetic acids, gibberelic acids, brassinolides and triacontanol, Synthesis of triacontanol. **[2L]** 2.4.**Antibiotics:**	**15L**

	Classification on the basis of activity and structure determination of penicillin-G, Cephalosporin-C and terramycin, Synthesis of penicillin-G, phenoxymethyl penicillin and Semi-synthetic cephalosporins. **[6L]**	
III	**NATURAL PRODUCTS CHEMISTRY-III** 3.1.Carbohydrates 3.2.**Types of naturally occurring sugars:** Deoxy sugars,amino sugars, branched sugars. Structure determination of lactose, inositol and amino sugars, Constitution and applications of chitin. **[6L]** 3.3.**Natural pigments: [4L]** General structural features, occurrence, isolation,biological importance and applications of– carotenoids,anthocyanins,flavones,xanthones,quinones,pterins and porphyrins, Structure determination and synthesis of β-carotene and ubiquinone. 3.4.**Prostaglandins: [3L]** Classification, General structure and biological importance. Structure determination and synthesis of PGE_1 and $PGF_{1\alpha}$ 3.5.**Lipids: [2L]** Structure and role of carbolipids,phospholipids and sphingolipids	**15L**
IV	**NATURAL PRODUCTS CHEMISTRY-IV** 4.1.**Vitamins: [5L]** Classification, sources and biological importance, Synthesis of B_1, B_2, B_6, D, E, K and compounds with vitamin-K activity. 4.2.**Multi-step synthesis of natural products: [10L]** Synthesis of the following natural products with special reference to reagents used, stereochemistry and functional group transformations-Reserpine,Longifoline, Griseofulvin, Estrone, β- Vetivone, 4-Demethoxy daunomycin, caryophyllin, etc	**15**

References:

1. Nelson, D. L, and Cox, M. M, (2008) Lehninger principles of Biochemistry 5th Edition, W. H. Freeman and Company, NY., USA.
2. Stryer, Lubert; Biochemistry; W. H. Freeman publishers. Voet, D. and J. G. Voet (2004) Biochemistry, 3rd Edition, John Wiley & sons, Inc. USA.
3. Zubay, Goffrey L; Biochemistry; Wm C. Brown publishers.
4. V. Polshettiwar, R. Luque, A. Fihri, H. Zhu, M. Bouhrara and J-M Basset, Chem. Rev. 2011, 111, 3036-3075;
5. R. B. Nasir Baig and R. S.Varma, Chem. Comm., 2013, 49, 752-770;
6. M. B. Gawande, A. K. Rathi, P. S. Varma, Appl. Sci., 2013, 3, 656-674;
7. J. Govan and Y. K. Gun'ko, Nanomaterials, 2014, 4, 222-214.
8. K. Philippot and P. Serp, Nanomaterials in catalysis, First Edition. Edited by P. Serp and K. Philippot; 2013 Wiley –VCH Verlag GmbH & Co. K GaA
9. D. Astruc, Nanomaterials and Catalysis, Wiley-VCH Verlag GmbH & Co. KGaA, 2008, 1-48;
10. C. N. R. Roa, A. Muller and A. K. Cheetham, The chemistry of Nanomaterials, Wiley-VCH Verlag GmbH & Co. KGaA, 2005, 1-11
11. The organic chemistry of drug design and drug action, Richard B. Silverman, 2nd edition, Academic Press
12. Medicinal chemistry, D.Sriram and P. Yogeeswari, 2nd edition, Pearson
13. An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New age international)
14. Burger's medicinal chemistry and drug discovery. by Manfred E. Wolf
15. Introduction to Medicinal chemistry. by Graham Patrick
16. Medicinal chemistry-William O. Foye
17. T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold's (Ed. Robert F. Dorge)
18. An introduction to medicinal chemistry-Graham L. Patrick, OUP Oxford, 2009.
19. Principles of medicinal chemistry (Vol. I and II)-S. S. Kadam, K. R. Mahadik and K.G. Bothara , Nirali prakashan.
20. Medicinal chemistry (Vol. I and II)-Burger
21. Strategies for organic drug synthesis and design - D. Lednicer Wiley
22. Pharmacological basis of therapeutics-Goodman and Gilman's (McGraw Hill)

Additional References:

23. Enzyme catalysis in organic synthesis, 3rd edition. Edited by Karlheinz Drauz, Harold Groger, and Oliver May, Wiley-VCH Verlag GmbH & Co KgaA, 2012.
24. Biochemistry, Dr U Satyanarayan and Dr U Chakrapani, Books and Allied (P) Ltd.
25. Bioorganic, Bioinorganic and Supramolecular chemistry, P.S. Kalsi and

J.P. Kalsi. New Age International Publishers
26. The Organic Chemistry of Enzyme-Catalysed Reactions, Academic Press, By Richard B. Silverman
27. Enzymes: Practical Introduction to structure, mechanism and data analysis, By Robert A. Copeland, Wiley-VCH, Inc.
28. The Organic Chemistry of Biological Pathways By John McMurry, Tadhg Begley by Robert and company publishers
29. Bioorganic Chemistry- A practical approach to Enzyme action, H. Dugas and C. Penny. Springer Verlag, 1931
30. Biochemistry: The chemical reactions in living cells, by E. Metzler. Academic Press.
31. Concepts in biotechnology by D. Balasubrarnanian & others
32. Principles of biochemistry by Horton & others.
33. Bioorganic chemistry - A chemical approach to enzyme action by Herman Dugas and Christopher Penney.
34. Medicinal Natural Products: A Biosynthetic Approach by Paul M. Dewick. 3rd Edition, Wiley.
35. Natural product chemistry, A mechanistic, biosynthetic and ecological approach, Kurt B. G. Torssell, Apotekarsocieteten – Swedish pharmaceutical press.
36. Natural products Chemistry and applications, Sujata V Bhat, B.A. Nagasampagi and S. Meenakshi, Narosa Publishing House.
37. Natural Products Volume- 2, By O. P. Agarwal.
38. Chemistry of Natural Products, F. F. Bentley and F. R. Dollish, 1974.
39. Natural Product Chemistry Vol.1 and 2, K. Nakanishi J. Goto. S.Ito Majori and S. Nozoo, Academic Press, 1974.
40. Chemistry of natural products, V.K. Ahluwalia, Vishal Publishing Co.

Course Code	**SEM IV M.Sc.-II Organic Chemistry**	**Credits**	**Lectures /Week**
24CHEMJPT1	**Practical 1**	**4**	**8**

About the Course:

After successful completion of this course, students would be able to –

CO1: Recall reactions of synthetic methods

CO2: To understand chemical tables, column chromatography

CO3: Apply the knowledge to find Solvent systems for column

chromatography

CO4: Analyze the purity of products before and after purification.

1	Acetophenone → Acetophenone phenyl hydrazine → 2-phenyl indole.
2	2-naphthol → 1-phenyl azo-2-naphthol → 1-amino-2-naphthol.
3	Cyclohexanone → cyclohexanone oxime → Caprolactum.
4	Hydroquinone → hydroquinone diacetate → 2,5-dihydroxyacetophenone.
5	4-nitrotoluene → 4-nitrobenzoic acid → 4-aminobenzoic acid
6	o-nitroaniline → o-phenylene diamine → Benzimidazole
7	Benzophenone → benzophenone oxime → benzanilide
8	o-chlorobenzoic acid → N-phenyl anthranilic acid → acridone
9	Benzoin → benzil → benzilic acid
10	Phthalic acid → phthalimide → anthranilic acid
11	Resorcinol → 4-methyl-7-hydroxy coumarin → 4-methyl-7-acetoxy coumarin
12	Anthracene → anthraquinone → anthrone

Minimum 8 Experiments

Combined spectral identification:

Interpretation of spectral data of organic compounds (UV, IR, PMR, CMR and Mass spectra) **(Minimum 12 spectral analysis)**

A student will be given UV, IR, PMR, CMR, and Mass spectra of a compound from which preliminary information should be reported within first half an hour of the examination without referring to any book/reference material. The complete structure of the compound may then be elucidated by referring to any standard text-book/reference material etc**.**

Reference Books:

1. Comprehensive Practical Organic Chemistry: Preparation and
2. Quantitative Analysis- V.K. Ahluwalia and Renu Aggarwal, Universities Press India Ltd., 2000
3. Advanced Practical Organic Chemistry – N. K. Vishnoi, Third Addition, Vikas Publishing House PVT Ltd

4. Systematic Laboratory Experiments in Organic Synthesis- A. Sethi, New Age International Publications
5. Systematic Identification of Organic compounds, 6th edition, R. L. Shriner, R. C. Fuson and D.Y. Curtin Wiley, New York.
6. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS
7. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall

Additional References:

8. Macro-scale and Micro-scale Organic Experiments, K. L. Williamson, D. C. Heath.
9. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
10. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clark, Adward Arnold.
11. Vogel's Textbook of Practical Organic Chemistry, Fifth edition,2008, B.S.Furniss, A. J.Hannaford, P. W. G. Smith, A. R. Tatchell, Pearson Education.
12. Laboratory Manual of Organic Chemistry, Fifth edition, R K Bansal, New Age Publishers.
13. Organic structures from spectra, L. D. Field, S. Sternhell, John R. Kalman, Wiley, 4th ed., 2011.

Course Code	SEM IV M.Sc-II (Organic Chemistry)	Credits	Lectures
24CHERPT3	**Research Project**	**6**	**90**

Evaluation Scheme for Second Year (PG) under NEP

(4 Credits)

I. Internal Evaluation for Theory Courses – 40 Marks

Continuous Internal Assessment 1 (Seminar Presentations) – 40 Marks

II. External Examination for Theory Courses – 60 Marks

Duration: 2.0 Hours

Theory question paper pattern:

All questions are compulsory.

Question	**Based on**	**Marks**
Q.1	Unit I	15
Q.2	Unit II	15
Q.3	Unit III	15
Q.4	Unit IV	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

- Each core subject carries 100 Marks
- Duration: 8 Hours for each practical course
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam

Evaluation Scheme for Second Year (PG) under NEP

(2 Credits)

I. Internal Evaluation for Theory Courses – 20 Marks

Continuous Internal Assessment 1 (Seminar Presentations) – 20 Marks

II. External Examination for Theory Courses – 30 Marks

Duration: 1 Hours

Theory question paper pattern:

All questions are compulsory.

Question	Based on	Marks
Q.1	Unit-I	15
Q.2	Unit-II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.
- Each unit will have 25% objective questions.